SEOUL NATIONAL UNIVERSITY
SCHOOL OF MECHANICAL AND AEROSPACE ENGINEERING

SYSTEM ANALYSIS **Spring 2014**

HW#4 **Assigned : March 26 (We)**
Due: April 7 (Mo)

1. Obtain the state model for the transfer function model

$$\frac{Y(s)}{u(s)} = \frac{6}{3s^2 + 6s + 10}$$

2. Obtain the state model for the system of the following equations of motion

$$10\ddot{x}_1 + 8\dot{x}_1 - 5\dot{x}_2 + 40x_1 - 25x_2 = 0$$
$$5\ddot{x}_2 - 25x_1 + 25x_2 - 5\dot{x}_1 + 5\dot{x}_2 = u(t)$$

3. A representation of car's suspension suitable for modeling the bounce and pitch motion is shown in Figure below, which is a side view of the vehicle's body showing the front and rear suspensions. The bid mass is m and its moment of inertia about the mass center is I_G. As usual, x and θ are the displacements from the equilibrium position corresponding to $y_1 = y_2 = 0$.

(1) Assume that x and θ are small, and derive the equations of motion for the bounce motion x and the pitch motion θ.

(2) Obtain state-variable model.

(3) Use matlab to obtain and plot the solution for $x(t)$ and $\theta(t)$ when $y_1(t) = 0$ and $y_2(t) = \delta(t)$. The initial conditions are zero.